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The Use of Hand Length Measurement in Estimation of Height Among Ibibio Tribe in Akwa Ibom State

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ABSTRACT

Since stature is being considered as one of the important parameters for personal identification, it is therefore necessary to reconstruct the other body parts for the prediction of human height, to be used in the case of dismembered body, mutilated body or in disease affected body. The aim of this study is to investigate the association of hand length with height in human subjects; and to see if height could be predicted using hand length measurement among the Ibibio people. 300 subjects (150 males and 150 females) of Ibibio people of Akwa Ibom State – also known as the Ibibio proper or the Eastern Ibibio, within the age range of 18-30 years were used for this study. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. The relationships between height and hand length were determined using Simple Correlation Coefficient with 95% confidence interval. P-value less than 0.05 were considered significant. Regression equations were drawn using linear regression statistics. The results showed mean value of height in males to be 169.78cm while the mean value of male left and right hand were 156.85mm and 156.68mm respectively. The mean value of height in females was 165.07cm and the mean values for the female left and right hands were 154.55mm and 154.44mm respectively. The results showed a highly positive significant correlation between Height and Hand length of both left and right hands ($P<0.01$). This study has established the use of hand length to accurately predict height of the Ibibio people.

Key Words: Hand Length Measurement, Height Estimation, Ibibio tribe, Akwa-Ibom

INTRODUCTION

Stature or height is considered as one of the important parameters for personal identification. It is the measurement of someone from head to foot (Oxford online dictionaries). The knowledge of ones height is important for determination of basic energy requirement, standardization and physical capacity. This human height varies greatly between individuals and across populations due to variety of complex biological, genetic, and environmental factors among others. The height a person reaches as an adult is a result of their genes as well as general health and nutrition during their years of growth. Normal growth is controlled by hormones such as growth hormone, sex hormones, and thyroid hormones. Base on genetic factor of growth, we can see that the child of short parent is more likely to be shorter than the child of tall parents. Although, there is a lot of variation; brothers or sisters with the same parents will not end up the same height, and parents can by chance have a child who is unexpectedly tall or short in relation to the rest of the family. Illness or poor nutrition during childhood or being small or premature at birth may mean children do not reach their full potential adult height. The average height of the population has gradually increased over the years because children have been better nourished and have had fewer illness and infections[1].

Moreso, human height is also determined by a combination of genetics and environmental factors. Genetics play the major role in understanding variation within a population. Normal variation in adult is largely due to inherited genetic factors. Within a population, typically 80% or more of the variation in height is explained by genetic factors[2]. Although it is clear that environmental factors contribute to differences between populations and to recent increases in average height across generations. The genetic contribution of height is largely attributable to the combined effects of many different genes, meaning that height is typically a polygenic trait[2,3]. The combined effects of many genes likely explain much of the variation within the normal range of height, but rare variants in single genes are more likely to play prominent role[2].

According to Vallo Tillmann[4], growth rate is determine by a complex interaction of physical, endocrine, and nutritional factors, of which growth hormone and nutrition are the key determinants of mid-child growth. James Tammer in Schell *et al*[5] described poor child growth as a reflection of terrible environmental conditions of the working class. Pollutant is recognized as prominent component of the modern environment which many studies of it revealed that some pollutants

depress growth while other speed sexual maturation and increase growth[5].

Later investigators in anthropology and other field clarified the connections between poor nutrition, disease, psychosocial stress and growth. The height status of an individual is very important to health professionals in predicting pulmonary function of children, assessing growth, determining crime culprit, determining nutritional status and calculating body weight[6] and also for adjustment of drug dosages[7]. Since the height of an individual is measure when standing erect, however in some situations the exact height cannot be determined directly when the individual is unable to stand as a result of neuromuscular weakness, deformities of axial skeleton such as kyphosis, lordosis, scoliosis, loss of lower limbs and in patient who have undergone amputations[8]. In such patients there is need for reconstruction of body part to estimate his/her height. Measurement of human height and it relationship with other human parts dated back to the first century BC, when Vitruvius put forth the proportions of human body in Book III, chapter I, that "the parts of temples should correspond with each other, and with the whole. The navel is naturally placed in centre of the human body, and, if in a man lying with his face upward and his hands and feet extended, from his navel as the centre, a circle be described, it will touch his fingers and toes. It is not alone by a circle, that the human body is thus circumscribed, as may be seen by placing it within square. For measuring from the feet to the crown of the head, and then across the arm fully extended, we find the later measure equal to the former".

As there are definitive biological relationships of different degrees between various dimensions/measurements of the extrimities and stature, many studies have used the measurement of the upper and lower limbs to estimate stature. Some examples include foot[9,10], hand[11], and arm span[12]. Forensic estimation of stature is part of the identification process necessary when dismembered body parts are found. Stature can be estimated from bone or from measurement of body parts such as finger, hand length etc. There is always a relationship between the different body parts and stature. Regression formula is being use in modern time to estimate stature from bones, fragments of bones, or measurement of body parts. In forensic investigations, the dimensions of the hand and foot have been used in the determination of sex, age, and stature of an individual. Stature reconstruction is important as it provides forensic anthropological estimation of height of a person in the living state which plays a vital role in the identification of individual remains[13,14].

The aim of this study was to investigate the association of hand length with height in human subjects; and to show if height could be predicted using hand length measurement among the Ibibio tribe of Akwa-Ibom State of Nigeria.

MATERIALS AND METHODS

Sample Collection: 300 subjects which comprises of 150 males and 150 females of the Ibibio Ethnic group of Akwa Ibom State, with no obvious deformities or previous history of trauma to their spine or hand were recruited for the study.

Data Collection: Measurements was taken in three higher institutions in the region, meaning that all participants were students. Letter was passed to the schools authorities for permission and a written valid informed consent was taken from each of the participants. Hand length was measured in millimetre (mm) using electronic sliding calliper (anthropometric instrument). Measurement was taken from both right and left side of the hand from each individual. Only individual with no hand and spine deformity were chosen for this study. A small group of 20 subjects were taken for measurement each day to avoid diurnal variations. The demographic data of the subjects collected include the age in years, name, parental origin (both paternal and maternal), sex and local government of origin were completed in the questionnaire. Standing height and hand length measurements were done taken.

The subjects were measured for:

1. Hand Length (HL): The hand length was measured with an electronic sliding calliper from distal flexion crease of wrist to the tip of the middle finger in extension after nails were trimmed. The subjects were asked to place their hand supine on flat horizontal surface with fingers extended and adducted. Measurement was taken in millimetre (mm)

Figure 1: Picture showing hand length measurement

2. Stature: standing height was measured to the nearest metres using anthropometric rod, with subject(s) standing erect on a horizontal resting plane bare footed in anatomical position. The height was measured from the sole of the feet to the vertex of the head as recommend by International Biological Program[14] (WHO,1995).

Figure 2: Demonstrative picture of height measurement

Statistical Analysis: Data were subjected to statistical analysis using statistical package for social sciences (SPSS) version 20.0. The relationships between height and hand length were determined using simple correlation coefficient with 95% confidence interval. A p-value less than 0.05 was considered significant. Regression equations were drawn using linear regression statistics.

RESULT

Table1: Correlation of height and hand length in males

Variables	Mean	Standard Deviation	N	Correlation coefficient (r)	P value
Height (cm)	169.78	3.88	150	--	--
Left hand length (mm)	156.85	1.28	150	0.634	0.000
Right Hand Length (mm)	156.68	1.28	150	0.929	0.000
Linear regression equation	Height (y) = 0.212 x + 130.63 * Right Hand length				
Linear regression equation	Height (y) = 0.209 x + 131.36 * Left Hand length				

Significant at p <0.01.

The correlation of height and hand length in males is as shown in table 1. There was a statistically highly significant positive correlation between Height and Hand length of right and left (P<0.01) for males. This study reveals that hand length of both sides are significantly more in those having more height.

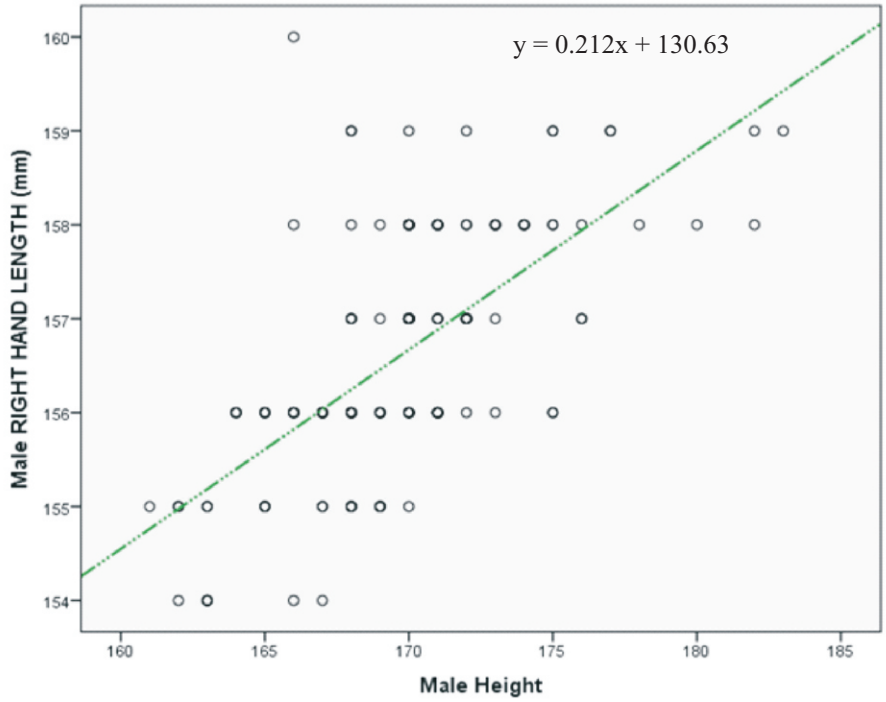

Figure3: Correlation between height and right hand length in males

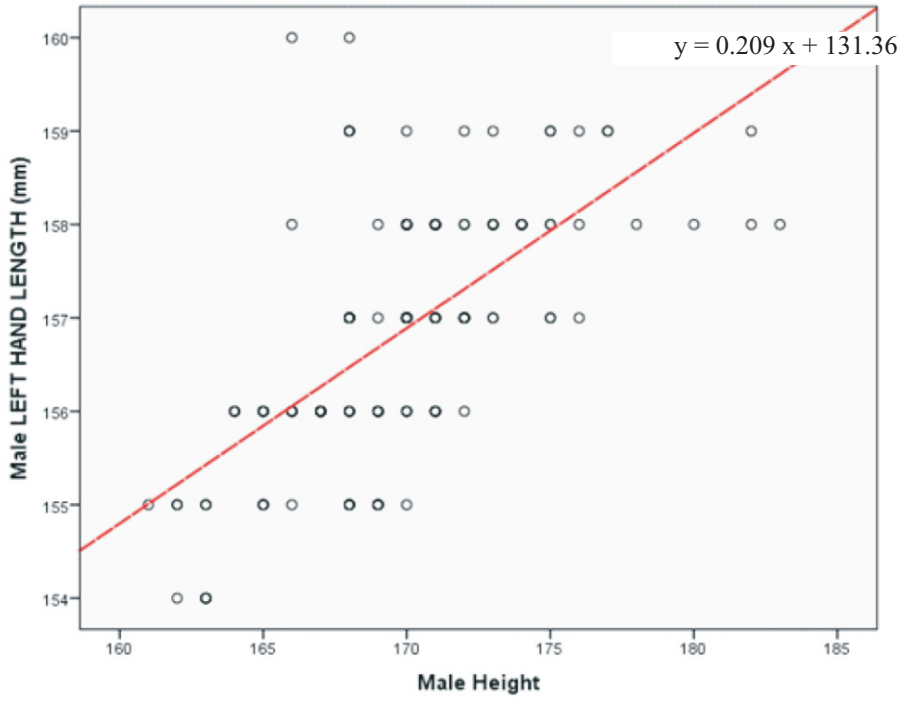

Figure 4: Correlation between height and left hand length in males

Table 2: Correlation of height and hand length in females

Variables	Mean	Standard Deviation	N	Correlation coefficient (r)	P value
Height (cm)	165.07	3.78	150		
Left hand length (mm)	154.55	1.04	150	0.362	0.000
Right Hand Length (mm)	154.44	1.06	150	0.336	0.000
Linear regression equation	Height (y) = 0.094x + 148.92 * Right hand Length				
Linear regression equation	Height (y) = 0.100x + 148.12 *Left hand Length				

Significant at p <0.01

The correlation of height and hand length in females is as shown in table 2. There was a statistically highly significant positive correlation between Height and Hand length of right and left (P<0.01) for males. This study reveals that hand length of both sides are significantly more in those having more height.

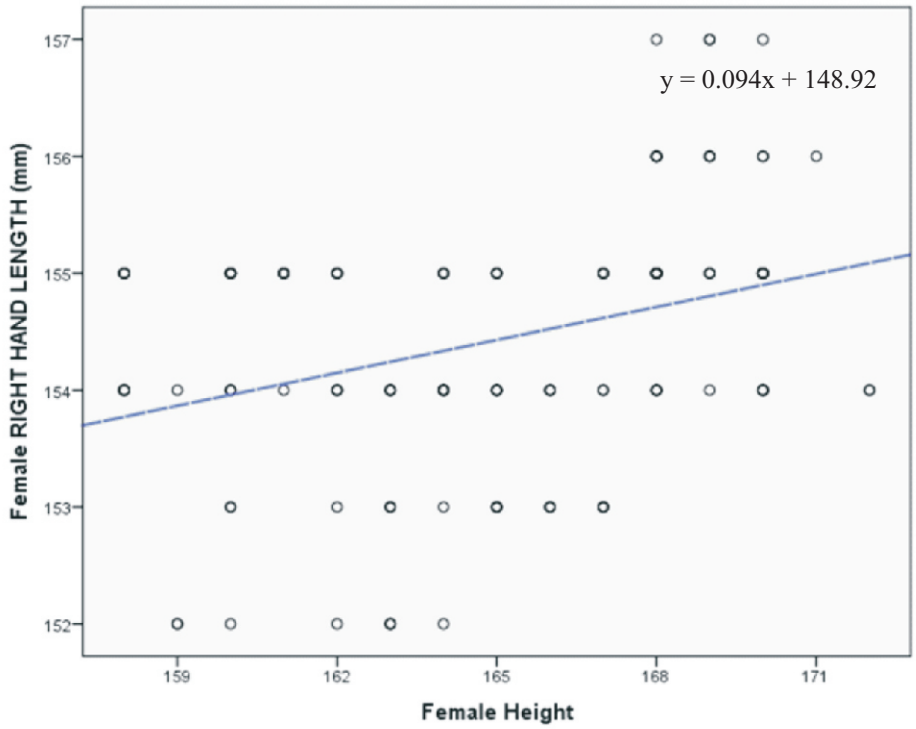

Figure 5: Correlation between height and right hand length in females

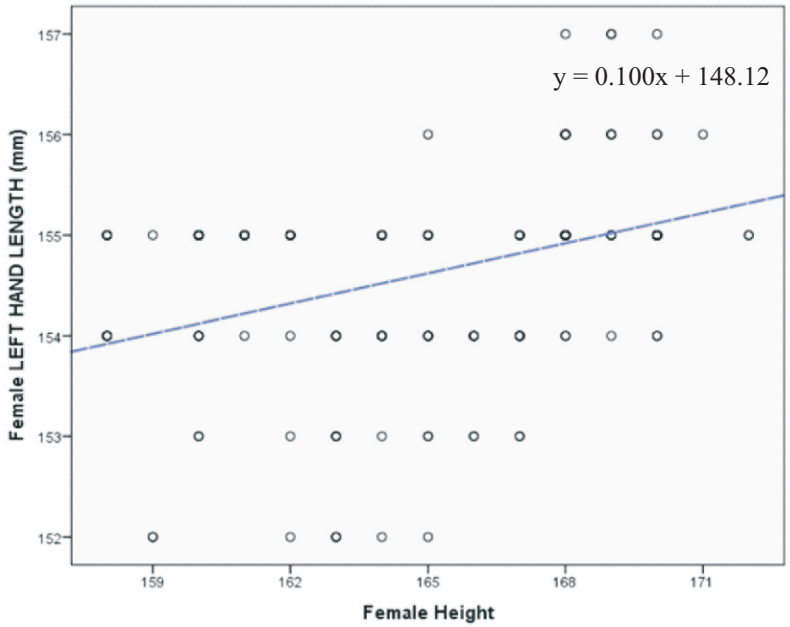

Figure 6: Correlation between height and left hand length in females

Table 3: Correlation of height and hand length between males and females

Variables	Male (N =150) Mean ± SD	Female (N=150) Mean ± SD	Correlation coefficient	P value
Height (cm)	169.78 ± 3.88	165.07 ± 3.78	0.035	0.675
Right hand length (mm)	156.68 ± 1.28	154.44 ± 1.06	0.055	0.504
Left hand length (mm)	156.85 ± 1.28	154.55 ± 1.04	0.034	0.680

Significant at p <0.01

Correlation of height and hand length between males and females is shown in table 3. There is non-significant difference in hand length (right and left) and Height between males and females (P<0.001).

DISCUSSION

The results from the present study showed that the mean and standard deviation of height in male Ibibio people was 169.78±3.88 whereas in females it was 165.07±3.78. The study also shows that the mean and standard deviation of right and left hand length in males were 156.68±1.28 and 156.85±1.28 respectively. The mean standard deviation of right and left hand length in females was 154.44±1.06 and 154.55±1.04 respectively. Therefore, the results showed that there was a positive correlation between height and hand length, indicating that height could be predicted using hand length.

The results of the present study showed that the dimension of hand length can be associated with height and can be used in the estimation of height. The parameter studied, showed a significant correlation with height, hence theses could be used by law enforcement agents and forensic scientists in the identification of the fragmentary dismembered human remain[15].

The results gotten from this study is unique in its kind, it can only be used to predict height of the indigenous Ibibio people and cannot be used with other tribes due to variations in racial and environmental factor.

Table 4: Comparative summary of work done by various authors on hand length and height.

AUTHOR	SAMPLE SIZE	PARAMETERS	MALES	FEMALES
Ilayperuma *et al.*[16]	258 (140 males, 118 females) of Sri Lanka	1. Height 2. Hand length 3.Correlation coefficient 4.Regression equation	170.14±5.22 19.01±5.22 0.58 S=103.732+3.493(HL)	157.55±5.75 17.62±0.93 0.59 S=93.689+3.625(HL)
Sunil *et al.,*[17]	150 (75 males, 75 females) of Delhi	1. Height 2. Hand length 3.Correlation coefficient 4.Regression equation	169±7.8 19.5±1.2 0.6 S=85.84+4.32 (HL)	158±5.8 18.1±1.0 0.7 S=80.94+4.40(HL)
Manpreet *et al.,*[18]	400 (200 males, 200 females) of North India	1. Height 2. Hand length 3.Correlation coefficient 4.Regression equation	175.98±6.76 18.80±1.09 0.589 S=130.90+2.398(HL)	160.91±5.75 18.54±10.72 0.550 S=160.41+0.027(HL)
Present study	300 (150 males, 150 females) of Ibibio	1. Height 2. Hand length 3.Correlation coefficient 4.Regression equation	169.78±3.88 156.85±1.28 0.634 Y=0.209X+131.36	165±3.78 154.55±1.04 0.362 Y=0.100X+148.12

From the table above, we can see that the hand length of the previous studies is not correlating with the hand length of this study, 156.85±1.28mm : (19.01±5.22cm; 19.5±1.2cm; 18.80±1.09cm) in males, and 154.55±1.04mm: (17.62±0.93cm; 18.1±1.0cm; 18.54±10.72cm) in females. This means that Indian has longer hand length than the Ibibio, this variation may be due to environmental factor and genetics[2,5].

CONCLUSION

The results gotten from this study has shown that hand length can serve as a tool for prediction of height of the Ibibio ethnic group. In cases where height cannot be measured directly from an individual such as in hyperkyphosis, hyperlordosis, sciolosis, lower limb amputation, neuromuscular weakness and dismembered body, hand lenght reconstruction could be useful and show high level of accuracy.

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